The well-earned Nobel Prize for the wrong reason

Peter Ostermann*

It was Ingeborg Bachmann who wrote the wonderful words, that truth is not expecting too much of the people. What have the elites learned from this? Today, there are some unreasonable ideas, argued to be not expecting too much, being claimed as elements of truth.

At first, however, one thing is clear: the recipients of this year's Nobel Prize in Physics, and the teams that they represent, have more than earned this honor. Theirs is the most significant and surprising success in instrumental cosmology since Slipher's and Hubble's first measurements of galactic redshifts. In an allusion to the statement made by the Committee when awarding the prize one could call it 'world-moving'. Unfortunately, this statement seems untenable: *"... for the discovery of the accelerating expansion of the Universe through observations of distant supernovae".* – What may be wrong?

The word 'universe' describes everything that is, was and will be; nothing therefore is outside of it. From a physical perspective this universe – coherent and primarily filled with light, matter and gravitation – has to be considered to be eternal and infinite; that means: stationary, homogeneous and isotropic on sufficiently large scales. This is because it would be meaningless to assign to it any peculiar properties that do not necessarily exist. It is always possible to argue that astronomic observations, which seemingly do not agree with the presupposition of no peculiarities, are just local deviations which will not occur over universal scales of space and time. Hence it is clear from the beginning that, in particular, any quantitative statements about *the universe* cannot be proved or disproved – or even checked definitely.

Unlike the word 'universe', meaning *all* of the world, the original meaning of 'cosmos' is *order* of the world. The fundamental importance of this distinction will become clear in what follows. It would be unnecessary to talk in pleonasms by speaking about the 'whole universe', if the actual concept has not been disregarded too much. Just in contrast to chaos, the concept 'cosmos' may include an evolutionary development.

Even after ten-thousands more years of unforeseeable technological progress no one will ever have seen the whole universe. It is perplexing that many people obviously seem to ignore this simple fact, which every child can understand – as long as modern theoretical cosmologists do not teach them any 'better'.

Now, thanks to the unexpected measurements of the *Supernova Cosmology Project* and the *High-z Supernova Search Team* there is a new chance to discover reason again there where it has been waiting in a half-shade over decades.

Initially, the basis of all cosmology is starlight in the night sky. I stand before it – like I stand before the whole of nature – knowing that there will never be any physical theory capable of fathoming this miracle completely. It was after Chéseaux and Olbers that cosmology first realized that it needed to find out what it means for this night sky to be dark; a fact that is not at all self-evident. Then there were the discoveries of redshift of spiral nebulae, of background radiation, and the observation that stars are not eternal, but come and go by.

Cosmology: a physics of reproducible experiments and falsifiable statements?

As a mathematical natural science, physics is founded not only on the possibility of falsifiable statements, but in fact above all on the wonder of reproducible processes. Considering a creation of the whole universe, however, cosmology cannot meet both of these essentials. Such cosmology would be myth instead of physics – and this myth would be overstrained if presenting a claim to scientific truth.

The current model is based on the restriction of a rational approach. The idea of a *cosmological principle* was already included in Newton's 'Principia' as well as in Einstein's first 'Considerations' on cosmology. In the sense of a now-historical 'Steady-state Theory' it demanded that with respect to appropriate scales the universe look the same at all points, in all directions, and *at all times*. Some decades ago, however – with respect to a putative temporal development – relativistic cosmology accepted the restriction, that the universe does look the same at all points and in all directions, but respectively only *at the same point of time.*

Therefore the first interpretation has been named *perfect* cosmological principle to distinguish it from the second. However, one should better leave the original statement's denomination intact, and treat the second statement as an *imperfect* cosmological principle instead. Because originally, a cosmological principle either holds or it does not – either fully intact, or *neither* in space *nor* in time.

Many physicists no longer believe that the universe formed from nothing. 'Proofs' to the contrary fail, because they do not take into account the quantum structure of matter. But as a rule, classical media mostly turn to dedicated mainstream authorities, who wish to avoid retrospective embarrassment, of course. Though everybody is free to speculate over every possible version – and, most excitingly, also impossible ones – the 'Big Bang' itself is about to come down to a universal dogma. But the more unquestioningly this dogma is defended, the more questions arise. When reading books on the subject, who never doubted the reality of the Emperor's new modern cosmology-spun clothes?

The situation evidently needs enlightenment. But here, it is not about 'the people', here it is about parts of the academic elite, who should know better.

Cosmology cannot avoid basing itself on natural philosophy, and deriving suitable presuppositions from it. Like the axioms of physics, these presuppositions cannot be proved. Obviously, they must not contain any unnecessary constraints, let alone constitute a dogma. Besides the necessary compatibility with past – and in this case also future – observations, they should also meet the fundamental criteria of simplicity, practicability and clarity. Without resorting to such criteria, nobody would even be able to distinguish between our heliocentric and the old geocentric system. This mathematical ambiguity can be proved by a mere coordinate transformation as a consequence of general relativity.

A beginning of the whole universe – according to present cosmology – is beyond the scope of any physical description, which naturally presupposes: *ex nihilo nihil fit* – nothing comes from nothing. Even those who think about quantum fluctuations of a so-called 'vacuum' are starting with something that is not nothing, but corresponding to an average energy density. Unfortunately, however, the Prize Committee notes that it is written in the stars: *"Both time and space began then."*

In contrast, at another point in the Nobel press release there is the refreshingly cool statement that the laureates *"... have helped to unveil a Universe that to a large extent is unknown to science."* How true! So little is known that relativistic big-bang cosmology and its predictions about the universe as a whole have possibly been on the wrong track from the start, and probably still are today. And yet the Nobel Prize was fully justified – for physics!

'Concordance' and 'consensus' – natural science by vote?

In fact there can be no doubt that the so-called Concordance Model is successful in numerically accounting for recent cosmological observations. Its 'predictions' seem to be confirmed brilliantly today; they are based on a speculative 'inflation' hypothesis, however, still in parts on a thirty years old first version which in the meantime has turned out to raise serious doubts. Nevertheless, the concept of a hot 'Big Bang', thus rapidly expanded, has proved to be enormously fruitful by leading – as a heuristic principle – to the stunning cosmological observations of the last years. But an almost arbitrary adaptability of the current model is both its strength and its weakness. Agreement with new astronomical discoveries can always be established by including some otherwise unproved *ad-hoc* assumptions. This extensive adaptability, obtained by a lot of artistic skill, brings to mind the Ptolemaic system that dominated astronomy for many centuries, from Aristarchus to Copernicus.

The highly speculative current model has since become essentially different to the original big-bang theory that once gained acceptance after the discovery of a background radiation which had been predicted to the correct order of magnitude. The reason why this radiation still does not prove anything definitely, however, follows from the fact that similar results were also derived from the 'Steady-state' approach mentioned above, whose express objective was to get rid of the big-bang hypothesis. That model has not been successful, though, in finding a process for the thermalization of its correctly estimated corresponding energy density so far.

Instead of first keeping the principles of well-established physics, and then drawing conclusions from observations regarding that part of the universe which is accessible to us, cosmology began reasoning just in the opposite way.

For example, an overall ionization of intergalactic gas is observed, although when allegedly the cosmic background radiation was released protons should immediately have bound with electrons to form neutral hydrogen atoms. This actually means a 'Big Bang'-disaster. But if, the other way round, a big-bang creation of the universe is *presupposed*, then the phenomenon of an otherwise only fictive phase of 're'-ionization suddenly is confirmed by observation, although the same observation originally was in clear disagreement with the model.

There are quite a few scientists who are looking for a way out of some unreasonable assumptions of modern cosmology, and who are thoroughly unconvinced by the usual excuses. An example for a plight of the concordance cosmologists is their appeal to an *anthropic principle* which is said to explain why we happen to live in the only short period of that universe in which it was possible for us to exist. According to this, the alleged age of the universe – otherwise considered as just random – seems determined by the implication that in all earlier and later periods of time there are no living beings to measure this age. The same kind of argument, however, could be used to explain why the earth is the center of the universe.

The anthropic principle is out of its place in a description of the universe as a whole, but has very much to do with describing our cosmos in it. The extension and the formation of observed structures from myriads of galaxies enclose many riddles. It seems like they simply did not have enough time to develop according to the 'rules' of modern cosmology – or might it be the other way round?

Because of the many adjustments leading to numerical success, this combination is called by the remarkable name *Cosmological Concordance Model.* This labeling might convey an association that scientists are trying to find the right model for the universe quasi by vote. Like in Galileo's time, something still seems to revolve around the power of interpretation. And it is not very encouraging to remember that the Ptolemaic System itself was the most successful concordant model for a long time – and even numerically more convincing, than thereon the original model of Copernicus. Some eccentricities of modern cosmology remind painfully of those planetary squiggles that were named 'epicycles'.

Present cosmology is seemingly trying to model a universe according to its prejudices. But what humans should do is to learn from the universe in wonder.

If the statement accompanying the Nobel Prize is going to mention an expansion of the universe at all – which did not really have to be the case – then it would have been more correct to formulate it like this: *If* the universe was created in a 'Big Bang', as modern cosmology presupposes, and *if* the redshift observed was really the manifestation of a Doppler-effect caused by motion, and *if* a perfectly homogeneous distribution of matter and energy can be assumed despite the immensity of existing structures, and *if*, correspondingly, the 'local' region of observed redshifts is representative of the whole – *then maybe* these researchers have discovered an accelerated expansion of the universe.

But otherwise? If only one of these four unproved assumptions is wrong, then the reasoning is wrong. In any case, however, it was unnecessarily speculative.

Even if the conditions hold, however, the demonstration would be incomplete, because some researchers claimed to have found 'evidence' not only of acceleration today, but also of a previous decelerating phase. Still not enough, according to that model there was a rapid inflationary expansion of the universe immediately after the beginning before that. And all of this must be true, just because there is unfortunately no other way to save *this kind* of big-bang theory.

But would any driver – the whole universe, though, cannot have come into existence correspondingly – would any such a driver of that Concordance Model be so senselessly drunk as to alternately accelerate, decelerate, and accelerate again without anybody ever getting in his way?

What is hiding behind the alleged expansion of the universe?

The following reasoning shows that a so-called expansion of the universe might be science fiction, given the meaning of this word: The physicists Pound and Rebka proved in a famous experiment that electromagnetic γ-radiation emitted from the foot of the Jefferson Tower in Harvard University arrives at the top with a tiny shift of wavelength towards the red end of the spectrum. This is due to the difference in gravitational potential, in turn due to a difference in altitude. After this experiment there could no longer be the slightest doubt: gravity can actually change the color of light. This effect was exactly predicted by Einstein and was called gravitational redshift, at first with respect to starlight. When the tower is twice, or three times as high, the effect is quite well twice, or three times as large. Hence, the greater the distance here between the source and the observer, the greater the redshift.

But there is also a totally different effect that can change the color of light – or the frequency of sound waves – correspondingly by relative motion of a source away from an observer. According to current understanding this effect bears no relation to gravity; it is called Doppler-effect, and in the acoustic case it is well known from daily experience.

Now, suppose that a redshift is reported by an observer at the top of the Eiffel Tower, when a light signal was emitted on the far bank of the Seine. Would any rational person conclude that the opposite bank of the river is receding, while Paris is expanding? Or may the top of the Eiffel Tower be fleeing away from its base?

It is clear that a redshift observed in this case would have nothing to do with motion or expansion. The other way round, however, naively interpreting the redshift as caused by a Doppler-effect seems to prove exactly such a nonsense.

With a physical description of the universe as a whole it is naturally all about gravitation. Therefore, today, every serious approach to cosmology is based rightly on Einstein's equations. Now, Hubble comes along and reports a redshift of light from spiral nebulae – the more distant the source, the greater the redshift. According not only to my understanding but also to Ockham's razor, this historical discovery should be interpreted as only a new variant of the gravitational redshift mentioned above.

Of course galaxies do move, but they do so irregularly and relatively slowly. Taking their statistically averaged positions, with respect to sufficiently large scales they stay where they are. And here we are once again: If the redshift was caused by a Doppler-effect, then galaxies are fleeing away. But if on average galaxies stay where they are, then there is a new variant of gravitational redshift. Both statements are *logically correct*, but which of them is *rational*?

Hubble was by no means ignorant of such reasoning. The interpretation using the Doppler-effect was suggestive, because time was involved in the corresponding solutions of Einstein's equations. At first sight, if time is present, then there is something changing, so the solution is not static, of course. But on the other hand, there have always been situations in which something happens without affecting the property of being *stationary*. One example of this is a vibrating string that produces a single note, which due to stationary waves always sounds the same.

Now, there are small peculiar motions contributing to the redshifts of supernovae and galaxies combined with the much larger Hubble effect occurring over universal distances. Why can't this redshift, measured before by Slipher and others as well as found in theory by Lemaître and Weyl, be primarily caused by gravity, in analogy to the effect measured by Pound and Rebka between base and top of the Jefferson tower?

It is true that usually one of these effects applies to local gravitational potential, in this case to that of the earth; the other concerns the gravitational potential of the background universe. Yet it seems obvious that in both cases one is dealing with previously unknown effects of gravity that can be derived from Einstein's system of equations completely analogously.

From its very beginning the theory of general relativity stated that gravity can cause redshift in spectral lines without the need for motion from any objects at all. Therefore, today, apart from historical and psychological considerations, it seems to become increasingly unclear how anyone can see here any single convincing, physical reason that makes a model of receding galaxies *necessary* for cosmology. On the contrary – where are they receding to?

Looking back after some more decades of relativity theory, this may be what has happened: an uncritical interpretation of the redshift of galaxies as exclusively the result of a Doppler-effect led to the development and general acceptance of the big-bang theory; though not, as might have been justified, modeling our 'local' cosmos, but modeling a strange universe as a whole.

What Riess, Perlmutter and Schmidt really observed

That which was *observed* by the astrophysicists Riess, Perlmutter, Schmidt and their teams is contained in the invaluable data that thankfully was easily accessible from the beginning. The apparent magnitudes of Type Ia Supernovae – used as standard candles of equal luminosity – were measured together with their redshifts, which are related to distance by the basically well-known extension of Hubble's original law. These are the facts.

That which was *discovered* in the facts was the overwhelming consequence that even some recently discussed, likely-looking relativistic models were been upset by reality. Since 1916, the following models in particular have been definitively discarded: Einstein's static closed universe with a so-called 'curvature' of three-dimensional space; the 'Steady-state Theory', which in spite of its reasonable intention did not deserve this name, because besides the need for a continuous creation of matter from nothing, it yields for example values of redshifts variable in time; and finally the Einstein-DeSitter model, that became prominent, once Einstein had decided: *"… then away with the cosmological constant!"*. No-one, so far, has seen the widely discussed 'dark energy', that is said to accelerate an expansion of the universe.

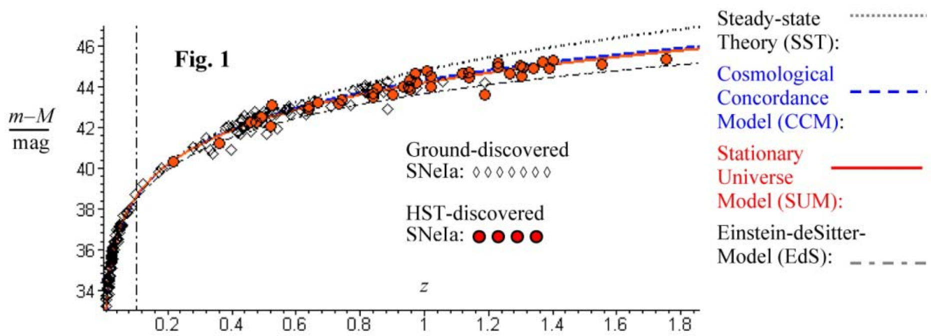
Instead of the 'Steady-state Theory', whose failure seemed to exclude just this chance, there has actually been a new *Stationary Universe Model*, SUM, for some years now. As must necessarily be the case, it yields values of redshift that are independent of time. Depicted together with the 'gold'-sample of Riess *et al.* in the diagram, its predictions concerning the Supernova Ia luminosities are compared to those of the Concordance Model, which is claiming that these same measurements prove an accelerated expansion of the universe as a whole.

Obviously, the predictions of both models, represented by the red solid and the blue broken line respectively, seem to coincide almost completely. Only when analyzed in detail does a small difference at the left of the vertical black broken line become recognizable; not discernible here, but significant.

In view of the stationary model this local deviation may indicate a small Hubble contrast within the range of various measurements due to an inhomogeneity of the average density, or a corresponding peculiar motion in our cosmic neighborhood; there also could be a faint dimming of light due to gray dust, most probably perhaps a *combination* of such effects. The presence of small anisotropies in the local deviations seems to support these assumptions; the existence of gray dust is observed, like the existence of large inhomogeneities, too. There is some irony in the fact that three outstanding members of the *High-z Team* – namely Jha, Riess, and Kirshner – also reported an effective Hubble contrast of just the right order to possibly explain the local deviations; though on basis of the new stationary solution, left unnoticed there.

In addition to today's Concordance Model, there has been another highly speculative inflationary approach where some early papers once referred also to a 'stationary universe model'. Besides this heading, however, that model has nothing to do with the SUM, which the diagram refers to, but seems to give rise to many totally separated 'parallel universes'. Each of them should be described by a variant of the concordance model respectively. The *one* decisive line element of general relativity, though, that will be able to describe the *one* coherent background universe is missing.

Now, to fit the average density of matter and energy according to the actual Concordance Model, which does match the data quite closely, one has to apply a 'strange recipe'. Firstly, take two inappropriate theories – in the diagram these are represented by the grey top and bottom lines – mix 2 parts 'Steady-state Theory' with 1 part Einstein-DeSitter model, and already one can see that you get the middle blue broken line, which is a very close fit to the measurements that evidently lie *between* the two. A similar method seems to be: A says 2 x 2 = 3, B says 2 x 2 = 6; splendid! says a concordance mathematician, we just need to take the suitably weighted average, 2:1 proportionally. With respect to strict standards any other correlation found in this way would be said to be manipulated. But facing the unexpected dilemma of theoretical cosmology – what else could have been done?



The grey diamonds and red filled circles show the Supernova-Ia data mostly from the 'gold-sample' of Riess *et al.* 2004/07, measured and evaluated with utmost care.

The middle blue broken line stands for the Cosmological Concordance Model (CCM), which claims that this diagram proves an accelerated expansion of the universe.

The data upsets all of the suggested models before, but coincides almost completely with the red line representing the new Stationary Universe Model (SUM).

"And everything is possible again", remarked the Nobel Prize Committee rightly, after unnecessarily fixing the grounds in their official statement, thereby having practically elevated the big-bang model of the universe to a dogma before.

At last perhaps this: Take the one and only cosmological solution of Einstein's equations that implies simultaneously a constant universal speed of light and redshift parameters independent of time. From these two postulates the line element SUM of a stationary universe can easily be deduced. It is represented by the red line of the diagram, and despite of its simple recipe this seems largely the same as the middle blue broken line of the Concordance Model.

It looks like another strange coincidence that those proportions of matter (approx. 26%) and 'dark energy' (approx. 74%) which are actually assumed by the Concordance Model can be theoretically derived from a natural claim – of the *stationary* model, though. To get a clear decision between the two alternatives from Supernova observations, it would be necessary to extend the measuring range up to higher redshift parameters, probably at least to $z > 6$, if possible.

In addition, it is worth noting that this stationary model includes some self-evident features right from the start which the Concordance Model had to explain retrospectively with dubious hypotheses of several inflation-'theories'. These features are particularly a universe without a so-called 'spatial curvature' over sufficiently large distances but with 'scale invariance' and objects so far apart that, according to the original big-bang model, light could never have travelled from one to the other – or might this prove that the inflationary phase was real?

How, later on, the stationary solution SUM was found only after the Supernova-data had been published but without knowledge of them, and why it remained undiscovered for so long – this, and more, is subject of a book in progress.

If Einstein's equations really had proved to be incapable of providing a rational solution to an open, spatially and temporally infinite universe without loops, flourishes or somersaults on sufficiently large scales, then the consequences would have been serious – for relativity that is. The diagram shows however the large-scale consistency of the new model with respect to the Supernova data, and thus provides another convincing proof of the peerless relevance of Einstein's equations, although not completely in the way that they are currently being interpreted. And there are even deeper reasons for their strength.

Aspects of the new solution with regard to a physical evolution

Besides this Supernova-confirmation, the question arises what does Einstein's relativity theory, or correctly: what do Einstein's equations say about the background universe? It is important to make this distinction, but that's another story and, as mentioned before, here it is not the place to elaborate on every other aspect of the new solution.

It actually turns out that the simplest deductive approach, proposed above, really describes a stationary universe. This is not only evident from its redshift parameters, which are independent of time, but the SUM approach is also supported by an always self restoring validity of special relativity within local inertial frames. Thus, this stationarity is much more a lively process than merely a 'steady state'. Above all, the following consequence – leading from the alleged single 'Big Bang'-origin of the whole universe to a concept of 'local bangs' within – is worth being considered explicitly.

The redshift parameters calculated from the stationary solution are only dependent on the 'coordinate' distances of the radiation sources. That is the distance with respect to coordinates which in the context of an expansion are called 'comoving'. Even those who argue in favor of an expansion of the universe accept that galaxies and quasi-stellar objects are statistically at rest with respect to these coordinates. But now, by measuring the values of redshift, these universal coordinates are measured unambiguously at the same time. In contrast to the interpretation accepted so far, they have immediate physical relevance. This conclusion, however, can only be realized after a historical misconception is explained – a related parameter had been mistaken for the actual redshift constant; it is hard to believe, yet a remarkable story, too.

But besides the intergalactic 'coordinate' distances, there are also the 'proper' extensions of local objects and standards, that – because of a reciprocal dependency on time between the universal and the proper quantities – do come to agree with the universal values again and again; but only ever temporarily, and not on a long-time basis. Thus there is a mathematically derivable conflict between local and universal dimensions. According to the stationary model, both of these scales should retain their dimensions, but this is evidently impossible over long periods of time. Hence, from this perspective the origin of a *physical evolution* becomes recognizable here, based on an eternal struggle of local cosmic structures against universal stationary distributions. That which was previously interpreted as the age of universe now becomes – once again by mathematical deduction – the maximum life time of those cosmic structures.

Even in a stationary universe there was of course a beginning billions of years ago, from which human life arose according to the principle of evolution. In exactly the same way every child has its own beginning, rightly celebrated as a *singular* event. But what adult would deduce that the world only began with his birth?

Considering the natural fact that obviously everything comes into existence and passes away, there is no physical reason for a beginning of space and time. The interpretation of the time-span previously referred to as 'the age of the universe', but now as the maximum life time of evolutionary structures, is particularly satisfying in this essential respect: on the one hand, physics cannot conceive of a beginning of the universe, but on the other hand eternal macroscopic objects are inconceivable, too.

This maximum age is a mathematical consequence of upper limits of proper length and proper time that in principle cannot be transgressed, while for example the Schwarzschild radius seems to be a limit on the short end of the scale. Just behind this limit of macroscopic physical applicability there might be processes that lead to a statistical stationary equilibrium of all cosmic structures.

Because of the limit on the life time of stars, galaxies and clusters, the stationary nature of the universe, which is assumed here, suggests that once in a while new structures will emerge – again and again. In reverse symmetry to the commonly known conflict of living organisms against decline and decay, there would be an interplay between large-scale entropic balance and local, newly recurring gravitational creation – though at first sight this seems to contradict fundamentally the principle of entropy.

Entropy is an indicator for statistical disorder or the probability of a system's state, and in general increases. This principle, founded on experience, has always proved to hold in every experiment or technical application, without any exception. Applied to the system which is discussed here, however, it only states that entropy always increases in evolutionary processes. This does not necessarily contradict the concept of a universal entropic compensation, if in extreme conditions of new local creation there are reverse short-time processes during which entropy *decreases* abruptly. In any case, this possibility cannot be ruled out, because even if it is true, no experiment ever performed by man would contradict a continuous increase of entropy within evolutionary structures. Hence, all experiments would easily give the impression that there are no exceptions to the principle of entropy.

Thus, given a stationary universe, all material components are determined by the requirement that they are gravitationally recreated according to the laws of quantum physics at the same rates as they have disappeared before in extreme gravitational centers, growing to cores of hot originating 'local bang' events.

This means that the material components of a stationary universe must exist at approximately those rates which were in fact calculated from the big-bang model. Those calculations do not exclude that for short times there are similar processes in other regions of extreme temperatures and densities. On the contrary, despite temporary local violations of the principle of entropy, from a physical perspective the scenario described here seems less unlikely than the formation of the whole universe from nothing, violating physical reason at all.

The fact that gravitation always acts as an attractive force also supports the possibility of a local decrease of entropy. This is contrary to the increase of entropy by the processes of diffusion, in exactly the same way that the negative gravitational pressure present in the stationary model differs from the always positive, regular pressure exerted by gas.

Some remarks on nucleosynthesis, background radiation, and dark matter

When concluding on an accelerated expansion, the Concordance Cosmology is referring to the fact that this seems consistently compatible with other observational data. But the price is high, involving a whole bundle of unproved hypotheses. On the other hand, it might take fewer and less incomprehensible hypotheses to adapt the stationary model, and to find here a fit, if not a 'best fit', for example with background radiation and all of its inhomogeneities, too.

Such a chance may even be self-evident: what spectrum would a background radiation show in a stationary universe, if not that of thermal radiation with small statistical fluctuations? The corresponding temperature estimated mathematically in this model is correct order of magnitude straight off. The problem how nature accomplishes this in detail, though, is unsolved so far. In any case, it's clear that she does.

Approximately just as seriously as the excellent George Gamow, who once on April 1st – in a famous 'α-β-γ'-paper – proclaimed a black-body background radiation as a relic of a 'Big Bang', now it shall be derived the other way round a confirmation of a stationary universe from that same radiation.

Imagine an empty unheated space capsule in form of a hollow sphere which is at a sufficiently large distance from strong localizable radiation sources. As a consequence of all the radiation being absorbed and emitted, the walls of the capsule will reach a constant temperature. If a fictitious observer inside this capsule drills a fictitious hole into the wall, this observer will be in the situation of a physicist measuring the cavity radiation of the stationary universe *enclosed outside* the sphere – which had to be 'proved'.

From the Concordance Model it is shown that acoustic oscillations play an important role. At first, however, based on an approach that – like the argument for the existence of dark matter in our cosmic neighborhood – estimates the rotation curves of spiral nebulae, the question is: what may actually be the temperature of this dark matter? If it had none, or did not emit radiation despite having a temperature, that would be another one, two more contradictions to proven physics.

When calculating some hypothetical distribution, assuming that pressure, volume and temperature are related in the same way as in regular gases, there are roughly similar rotation curves as were actually observed if the temperature of this dark matter in each galaxy is constant. Whether it could be the same for all of them depends on masses and proportions of the corresponding particles. This seems to be an unexpected hint to that black-body radiation, which has actually been observed, although until now it is attributed exclusively to a 'Big Bang' of the whole universe.

The suggestion that dark matter might consist of neutrinos is commonly considered to have been disproved. But nothing of this idea has really been disproved, as long as such a 'proof' – like almost every other analysis of cosmic observational results today – is contaminated by the doubtful presupposition of a Concordance-'Big Bang'. Some alleged upper boundaries of neutrino rest masses are also based on this assumption.

Since the three types of neutrinos observed actually do have rest masses, it follows that despite travelling at approximately the speed of light after their release they will be slowed down by the gravitational field of an infinite universe to thermal velocities, if they are not involved in inelastic collision processes before.

Dark matter could therefore be fully – or at least partially – responsible for the observed cosmic background radiation, possibly with different combinations of the three types of neutrinos or other weakly interacting particles in each galaxy. Of course, this concept can only be considered a working hypothesis so far.

Similarly, nobody can know for sure that there never are any sufficiently hot local densification processes in the active nuclei of galaxies denoted Quasars, which – eluding direct insight – are already releasing enormous amounts of energy continuously. There are gamma ray bursts that even set free more energy in a few seconds than the sun over billions of years, and can therefore be millions of times brighter than the most luminous supernovae. Hitherto unknown objects, not constantly the same, may run through various phases as Quasars, black holes, or hypernovae, for example.

The possibility seems not inconceivable that the prehistory of all matter entering gravitational origination centers is erased, that the rules of entropy break down there, and that the light elements hydrogen and helium are partially created anew. Finally, the claim that *quasi-stellar objects* can only occur at very large distances would be rather self-evident, if the evolution of our 'local' cosmos had started in such an event.

From this perspective, nothing should disappear for ever in 'black holes'. Instead, these might one day become 'white sources' temporarily. In the context of theoretical physics, however, it remains speculation until Einstein's equations are solved for a quantized stress-energy-momentum tensor of matter; this may take much more time. Unfortunately, Einstein's otherwise incredibly successful phenomenological approach breaks down at this point.

Therefore also primordial nucleosynthesis, seen as a third pillar of the Concordance Model explaining the observed distributions of the light elements, actually only proves that there obviously have been such 'local bang' events, but does not prove that there was only one 'Big Bang', at only one time, in only one place.

Mistaking our cosmos for the stationary universe

The alleged discovery of an accelerated expansion of the universe seems to me equivalent to the supposed discovery of one famous navigator some five hundred years ago. Would anybody ever think of criticizing Columbus for the fact that his new continent was not India?

It is nearly impossible to believe that all of the various predictions of the Concordance Model – for example concerning background radiation – are coherent by chance and correlate with observations purely by coincidence. Though, even in this context, there still is the question of cosmos and universe. How might this all be compatible to each other?

It could be helpful to take a sidelong glance at the Bible. That 'Tohu-va-bohu', before it was said 'Let there be light', could possibly be interpreted – with all due respect – as the universe in which our evolutionary cosmos originated one time; together with the laws of nature also the potential for life must have been in that chaos, hence anything but a senseless state.

By *cosmos*, I am referring to any largest structure in a stationary universe which underwent evolutionary development from a joint origin. Thus *our* cosmos refers to that *largest* individual structure which contains *at least* our solar system.

These considerations are unrelated to any movements of 'Creationism' or 'Intelligent Design' in a sense of arbitrary interventions into evolution, of course. On the other hand with the words, one still must have chaos in oneself to be able to give birth to a dancing star, even the 'godless' Nietzsche was referring unmistakably to the Genesis.

The current situation with its obvious mistake between the cosmos and the universe may only be understood from a historical perspective. It should be possible to resolve some fundamental problems by making the above distinction. What modern cosmology describes as a structure unevenly evolving with time cannot be the whole universe.

If at all, only the stationary solution offers the chance of keeping the Concordance Model as a description of our cosmos without having to assign all of its implausible features to the whole universe; in particular concerning those problems which arise from strange 'coincidences' and 'fine-tuning'.

In the system of the previously mentioned coordinates with respect to which the galaxies are at rest, the Concordance Cosmos is estimated to span around seven times the Hubble length, so seven times a distance of order ten billion lightyears. What would be there beyond this distance, if not space and time for other cosmoses? Existing within the one and only infinite universe, however, these would have nothing to do with any abstruse fictions of 'parallel universes' connected by 'wormholes of space-time'.

It seems almost a miracle to me that after all on basis of Albert Einstein's equations the idea of an *infinite* stationary universe turns out to imply clear indication that individual cosmic structures have *finite* dimensions in space and time. This conclusion arises from the interplay of local special relativity, macroscopically representing quantum mechanics, and universal general relativity, representing gravitation. It is amazing how a mathematically structured model – describing our cosmos as part of a stationary universe – brings to mind some creation myths of various world religions at the same time.

One question remains last – how far do the limits of this cosmos actually reach out in space and time. Where and when does the realm of our physical evolution merge into the infinite universe?

If what the Prize winners measured was not already a representative part of the stationary universe – the diagram suggests however that this may probably be the case – then they might have observed *our cosmos*, but not at all an accelerated expansion of the universe as a whole.

There is no absolute truth about this universe, except for the fact that it exists. In this sense, cosmology is and always will be interpreting the stars – though not in the sense of decrepit astrology, of course, which no longer bears serious relationship to the precursors where astronomy rose forth, like chemistry from alchemy, and elementary particle physics from the quest for the Materia Prima. But maybe there is a slightly tortuous thread that connects the observations of the *Three Wise Men* long time ago and the enlightening measurements of supernovae today, which whoever so inclined may see as a gift from God – though a gift that obviously no-one has been able to understand at first sight.

Altogether, this Supernova data may turn out to be that pillar which can take – in replacing the dogmatic version of big-bang cosmology – the weight of a new open physical model; not least according to the original intention of Einstein's first paper on this subject. Now there is hope.

Long before any of the award-winning data had been gained, Max von Laue, a German physicist, Nobel prize winner, author of the first textbook on relativity theory and highly esteemed by Einstein even after the war, stated in his History of Physics: *"And when the theories shift, a decisive proof for the one can easily become just as strong an argument for another totally different one."*

* <peter-ostermann.org>

The article is based on two talks held at the
12. Marcel Grossmann Meeting in Paris 2009:

"Indication from the Supernovae Ia Data of a Stationary Background Universe"
<www.icra.it/MG/mg12/talks/cot2_ostermann.pdf>
(This talk with many figures is particularly self-explanatory at view in the full-screen mode)

"Relativistic Deduction of a Stationary Tohu-va-Bohu Background Cosmology"
<robot.icra.it:8080/store/l189.pdf>

In all cases of doubt
– as well as to find the original words of some quotations above –
please have a look at the German-language e-print of the same date
as a corresponding version of this essay.